Dr. Blackham said, He had never found it necessary to make any difference of adjustment to secure actinic focus. He always used the eye-piece, and used an ordinary kerosene lamp as the source of light.

Mr. E. S. Nott said, There was a difference between the visual and actinic foci, even when the eye-piece is used, but it is less in amount.

"Preparation and Mounting of Brain Sections."

Dr. Theodore Deecke described his method of preparing and examining large sections of the brain. He first exhibited some of his large preparations, showing sections through the entire brain, the slides being 6x10 inches, and stated the reason why such large sections were desirable in the study of such organs as the brain, viz. that their various parts may be seen and studied in their true, original relations, and any lesions or morbid anatomical structure ascertained and noted in its proper plane.

The microtomes are heavy brass cylinders resembling in form those employed by microscopists for years. The largest one is nine inches in diameter and fourteen inches high, and closed at the bottom. A closely-fitting piston three inches thick, is moved from the bottom upwards by a strong but fine micrometer screw, one inch in diameter, with thirty threads to the inch. The head-piece of the screw, six inches in diameter, is divided into forty degrees, so that the piston can be raised with great ease the twelve-hundredth, the sixth-hundredth, the four-hundredth, the three-hundredth part of an inch, etc., thus graduating accurately the thickness of the section. The upper part of the cylinder, upon which the knife has to rest, is mathematically even, and is ground off and polished on the same plate as the lower surface of the knife, so that the two correspond to each other with the highest degree of accuracy. The knives are of the following construction; for the largest is used a blade with upright handles, the cutting edge of which is sixteen inches long, one and one-half inches broad, and one-quarter of an inch thick at the back, to which a steel rod is attached by screws, which projects one-sixteenth of an inch downwards, so that the knife, when placed upon

the section cutter, rests only upon its edge and the rod, leaving a hollow space between the lower surface of the blade and that of the cylinder, an arrangement by which an adhesion between the two is prevented as much as possible. When the instruments are made accurately, this arrangement enables the operator to move the knife forward with a slight sawing motion, while the weight of the knife itself fully suffices to prevent any deviation from its course. This manner of cutting, of course, demands practice and a light, firm and steady movement of the hand, but no machinery can be constructed superior to its guiding. It becomes necessary after each step forward to draw the knife a little back in order to be sure of not losing a particle of the section. The sections will always show slight traces from this way of cutting; this does not, however interfere in the least with the examination of the specimens or with their beauty; in fact they are so slight, that they can scarcely be recognized after the section is mounted.

Moreover, the longer the instruments are in use, when carefully kept, the more perfect they become. This manner of cutting has advantages over that in one sweep, in that the sections come out much more uniform in thickness and more perfect in all parts: furthermore, there is no necessity to remove, before hardening the organ, the membranes, vessels and choroid plexus, which can never be done without extensive injury to the brain, often preventing the full presentation of the morbid appearances; for in the majority of cases a most important link in the chain of evidence may thus be lost. The brain for section is first placed in proper position by the aid of pieces of soft cork; is then embedded in a cast of paraffine and oil. Before cutting, and as it proceeds, this cast is carefully removed from around the specimen, to the depth of about one-half inch, which is easily done by the use of a good-sized carpenter's chisel. Thus the knife never comes in contact with the cast, which would blunt its delicate edge quicker than the soft tissue of the brain. It is most important to keep the knife in good order; for this purpose the laboratory should own the normal plate upon which the knife and the section cutter were ground. Each time before the knife is sharpened, the oilstone employed for the purpose should be made level and true, and this can best be done by rubbing it over the plate smeared with

oil and fine emery flour. The sections are cut under alcohol; to accomplish this, a basin of copper eighteen by thirty inches wide and four inches deep is firmly placed upon a table frame; the bottom is slightly inclined toward the outer border, and has in the center a perforation just large enough to permit the passage of the microtome. The edge of this opening is raised to the height of one inch, and upon it rests the under surface of the brim of the microtome, the space between the two being made impervious to the alcohol by the intervention of a solid, round rubber ring. The sections, stained, washed, and cleared up, are finally mounted in Canada balsam, on slides of English flattened plate glass, five by seven and six by eight inches, and covered with the thinnest covering-glass so as to allow the application of high microscopic powers. To transfer the sections to staining fluids and to the slide, he slipped a sheet of writing-paper under the section in the fluid, and so carried it to the next fluid, which it would be impossible to do with ordinary trowel or tweezers. He usually mounted the sections in balsam diluted with chloroform or benzole, and, with proper care, found no more difficulty from air-bubbles in these large slides than with the ordinary 3x1 inch size. He usually passed the sections through oil of cloves before mounting. For the purpose of examining specimens of such dimensions, he had constructed a large microscope stand, which combines some of the best mechanical principles adopted by American, English, French and German manufacturers. A great number of new arrangements had to be added for the easy management of an apparatus of such weight and dimensions. The height of the instrument from the heavy triangular plate upon which it rests, to the arm to which the tube is attached, is eighteen inches. It can be placed in any position, from the vertical to the horizontal, by the aid of a screw at the base, twelve inches long, with a handle at the back side, in front of the operator. The turning of this screw sets the bar of the instrument, which is accomplished by the movement of a second, smaller, triangular plate, against the one which supports the whole instrument, in joints connected with their base parts.

The head part of the upper one is attached by a hinge to a third triangular plate, to which the bar is fastened, and which supports the stage. The stage consists of two heavy plates movable against each

other by the aid of screws on the right and left side of the instrument, allowing a motion of four inches from the center in each of the four directions. On the upper surface, the stage bears the arrangement for supporting the slides. To the left, front corner of the stage, a right-angled arm is attached, movable against a spring, the end of which projects downwards to the center of the stage, while in the center of the rear part, projecting upwards, a double-armed supporter is fastened, with an opening angle from 10° to 160°. This allows slides of any size from one by three inches up to six by eight inches to be placed between these arms. At its lower surface the stage bears a slide in which the diaphragm is movable. The illuminating mirrors can be moved by joints in all directions, below as well as above the stage; the latter arrangements render the use of a bull's eye condenser superfluous. The arm connected with the bar and destined to support the tube, is twelve inches long and bears in it the arrangement for the fine adjustment, on the principle of a balance movement against strong springs. It is of a very solid construction in order to prevent as much as possible all trembling motion. The instrument is placed upon a solid, revolving table, fifteen inches high, which permits of free movement and easy management.

In order to photograph these large sections, and to make practicable and render possible the focusing of large areas, I have constructed the following apparatus: Upon the front of a solid wooden stand, twenty inches long, twelve inches broad, and two inches high, which can be raised and levelled by the aid of screws at its bottom, is erected at a right-angle a heavy brass plate fourteen inches high by twelve inches broad, with a hole in its center of six inches diameter. Inserted in this plate are two small perforated disks sliding one in front of the other, in such a manner that they can be moved up and down and to the right and left by the aid of strong screws. The front disk supports the objective, which by this arrangement can, with great ease, be set exactly in the axis of the pencil of rays furnished by the heliostat. The back part of the stand bears a simple wooden frame which fits close to the shutters of the window, enclosing in its center the condenser from which the conical tube has been removed. The upper corners are connected by brass bars with those of the front piece. The whole stand is darkened by a velvet

mantle, which can be easily turned back, allowing a glance into the interior part from all sides. Between the face and back, the stand is provided with two more frames sliding on a metal track, the rear one being used to support a curvette with a solution of ammoniated sulphate of copper, the other for receiving the specimen. This latter one is so constructed that a perforated metal plate, the stage upon which the specimen rests, can be slipped into its center-piece which, hanging in a frame with horizontal conical points, allows a rotation in its horizontal axis. This frame rotates in a second one in its vertical axis, and this in a third one which permits of a movement of the whole to the right and left. All movements are accomplished and regulated by fine screws, and serve the purpose of placing the specimen on the one hand in the center of the condenser, and on the other in a plane rectangular to the axis of the pencil of rays. Besides this, the arrangement enables the operator to correct the minutest inequalities of the section itself, by placing it as may be required in a slightly oblique position, which will in focusing large areas on the screen, be found of the very greatest importance.

The fine adjustment-screws for the lens as well as those which regulate the position of the object, are manageable at any distance from the apparatus, by the aid of cords running at the right side of the track upon which the screen moves, over a system of pulleys, which can be also connected with the fine adjustment of the microscope. These arrangements are practically not only of importance for the purpose of facilitating the work, but they are indispensable to success.

In photographing these sections up to twenty-four or thirty-six inches square, he divided the field into four quadrants by two fine wires, and photographed each quadrant separately, afterwards putting together the printed positives by making these lines coincide properly.

In answer to questions from Prof. Gage and others, Dr. Deecke said, That in order to harden the entire brain so that the inside and the outside shall be hardened equally and properly, he had, after using several hardening methods with more or less success, finally adopted bichromate of ammonia in a very weak solution—one-half to one per cent. solution—according to the consistence of the brain;

for the nervous tissue is sometimes softer than at others. When nominally soft he added a small amount, say one-sixth to one-tenth per cent. of chromic acid to the solution, and always from one-sixth to one-fourth of the whole volume of alcohol. Then the vessel containing the brain and fluid is placed in a refrigerator and kept as cool as possible, and the fluid changed frequently, especially at first. After a month add a little more alcohol from week to week until the brain is surrounded with pure ninety per cent. alcohol. This is then changed as often as it becomes colored with any coloring matter, extracted from the tissues. By this treatment, which requires from twelve to eighteen months, the whole brain is thoroughly and equally hardened, yet the sections will not in any way injure the knife. The determination of when the treatment is fully completed is a matter to be only learned by experience—the touch, when felt by the fingers, being the guide. If the brain be overhardened it must be thrown away—it is not worth cutting.

The bichromate of ammonia treatment does not forbid injection also. I have not used it in the case of the whole human brain, but have in the brains of animals, and in portions of human brain. It can be done while the brain is still in the head. very successfully, though not so well after removal, and the subsequent hardening can proceed without difficulty.

Prof. S. H. Gage said, Dr. Lumley has succeeded finely in injecting alcohol into the whole head, using it quite dilute at first, and increasing its strength from day to day, till the brain was hardened, thus avoiding the distortion produced when the brain was removed from the skull before hardening. He wished to know if this could not be done also with the ammonia bichromate solution used by Dr. Deecke.

Dr. Deecke said, He thought it would be a very good thing to do, using a weak solution—say one-half per cent., to begin with.

Dr. Thomas Taylor said, It would be well to inject the coloring matter in a gelatinous fluid, as that made the smoothest cutting and the most valuable objects of study, and also to put some sulphate of zinc along with it, as that was an excellent antiseptic.